31. **(Once Amended)** A fabrication method for a semiconductor laser apparatus to be operated at a desired optical output power level from a source of electric drive power, the desired optical output power level being greater than 50 mW, the semiconductor laser apparatus having a semiconductor laminated structure formed on a substrate, the laminated structure including a lower cladding layer, an upper cladding layer, an active layer disposed between the lower and upper cladding layers, a front facet to output the laser beam, a back facet, and a cavity length between the front and back facets, the active layer being configured to generate light such that the apparatus provides optical output power at the front facet in response to the source of electric drive power, the fabrication method comprising:

acquiring a relationship of the electric drive power as a function of the cavity length and the optical output power level of the semiconductor laser apparatus, the relationship including cavity lengths greater than 1000 μm and optical output power levels greater than 50 mW;

determining a value of the cavity length from the acquired relationship such that the electric drive power is vicinal to a minimum for the desired optical output power level and such that the value of cavity length is greater than 1000 μm, the desired optical power level being greater than 50 mW; and

forming the semiconductor laser apparatus having the value of the cavity length determined by the cavity length determining step.

33. **(Once Amended)** A fabrication method for a semiconductor laser apparatus to be operated at a desired optical output power level from a source of electric drive power, the desired optical output power level being greater than 50 mW, the semiconductor laser apparatus having a semiconductor laminated structure formed on a substrate, the laminated structure including a lower cladding layer, an upper cladding layer, an active layer disposed between the lower and upper cladding layers, a front facet to output the laser beam, a back facet, and a cavity length between the front and back facets, the active layer being configured to generate light such that the apparatus provides optical output power at the front facet in response to the source of electric drive power, the apparatus having a

photoelectric conversion efficiency defined as the ratio of the optical output power to the electric drive power, the fabrication method comprising:

(a) acquiring a relationship of the photoelectric conversion efficiency as a function of the cavity length and the optical output power level of the semiconductor laser apparatus, the relationship including cavity lengths greater than 1000 μm and optical output power levels greater than 50 mW;

(b) determining a value of the cavity length from the acquired relationship such that the photoelectric conversion efficiency is vicinal to a maximum for the desired optical output power level and such that the value of the cavity length is greater than 1000 μm, the desired optical power level being greater than 50 mW; and

(c) forming the semiconductor laser apparatus having the value of the cavity length determined by the cavity length determining step.

A2 concl

34. **(Once Amended)** A fabrication method for a semiconductor laser apparatus according to Claim 33, wherein step (b) comprises:

obtaining, from the relationship acquired from step (a), an expression between cavity length and optical output power which describes combinations of cavity lengths and optical output power levels that make the photoelectric conversion efficiency maximal; and

determining the value of cavity length on the basis of the expression.

39. **(Once Amended)** A fabrication method for a semiconductor laser apparatus to be operated at a desired optical output power level from a source of electric drive power, the semiconductor laser apparatus having a semiconductor laminated structure formed on a substrate, the laminated structure including a lower cladding layer, an upper cladding layer, an active layer disposed between the lower and upper cladding layers, a front facet to output the laser beam, a back facet, and a cavity length between the front and back facets, the upper cladding layer having an impurity carrier concentration, the active layer being configured to generate light such that the apparatus provides optical output power at the front facet in response to the source of electric drive power, the fabrication method comprising:

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(a) acquiring a relationship of the electric drive power as a function of the impurity carrier concentration of the upper cladding layer and the optical output power level of the semiconductor laser apparatus;

(b) determining a value of the impurity carrier concentration from the acquired relationship such that the electric drive power is vicinal to a minimum for the desired optical output power level; and

(c) forming the semiconductor laser apparatus with the upper cladding layer having the impurity carrier concentration set to the value determined by the carrier concentration determining step.

A4

41. (Once Amended) A semiconductor laser comprising:

a semiconductor laminated structure having a substrate, a lower cladding layer, an upper cladding layer, an active layer disposed between the lower and upper cladding layers, a first electrode, a second electrode, a front facet to output the laser beam, a back facet, and a cavity length L between the front and back facets, the active layer being configured to generate light such that the apparatus provides optical output power at the front facet in response to a source of electrical power applied to the first and second electrodes, the cavity length L being in the range of approximately 1000 μm to approximately 1800 μm;

a low reflectance coating disposed on the front facet having a reflectivity of less than approximately 4%;

a high reflectance coating disposed on the back facet and having a reflectivity of more than approximately 80%;

a power supply coupled to said electrodes and applying an amount of power which causes the semiconductor laser to operate with an optical output power level P_{OUT} that is maintained within a range that is less than or equal to a specified upper bound and greater than or equal to a specified lower bound, the specified upper and lower bounds being based on the cavity length L,

the specified lower bound having a value of 50 mW for cavity lengths between approximately 1000 μm and 1380 μm, a value equal to the quantity (1mW)*[(L-1280μm)/2μm)] for cavity lengths of 1380 μm to 1480 μm, a value equal to the quantity (1mW)*[(L-1260 μm)/2.2μm)] for cavity lengths of 1480 μm to 1700 μm, a value equal to

A4 cont'd

the quantity (2mW)*[(L-1600 µm)/1µm)] for cavity lengths of 1700 µm to 1750 µm, and a value of (3mW)*[(L-1510 µm)/2µm)] for cavity lengths of 1750 µm to approximately 1770 µm, and

the specified upper bound having a value equal to the quantity (2mW)*[(L-950µm)/1µm)] for cavity lengths of approximately 1000 µm to 1050 µm, a value equal to the quantity (2mW)*[(L-750 µm)/3µm)] for cavity lengths of 1050 µm to 1200 µm, a value equal to the quantity (2mW)*[(L-450 µm)/5µm)] for cavity lengths of 1200 µm to 1350 µm, a value equal to the quantity (3mW)*[(L-150 µm)/10µm)] for cavity lengths of 1350 µm to 1450 µm, and a value equal to the quantity 390 mW for cavity lengths of 1450 µm to approximately 1770 µm.

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49. (Once Amended) A semiconductor laser comprising:

a semiconductor laminated structure having a substrate, a lower cladding layer, an upper cladding layer, an active layer disposed between the lower and upper cladding layers, a first electrode, a second electrode, a front facet to output the laser beam, a back facet, and a cavity length L between the front and back facets, the active layer being configured to generate light such that the apparatus provides optical output power at the front facet in response to a source of electrical power applied to the first and second electrodes, the cavity length L being in the range of approximately 1000 µm to approximately 1800 µm;

a low reflectance coating disposed on the front facet having a reflectivity of less than approximately 4%;

a high reflectance coating disposed on the back facet and having a reflectivity of more than approximately 80%;

an optical output power level P_{OUT} maintained within a range that is less than or equal to a specified upper bound and greater than or equal to a specified lower bound, the specified upper and lower bounds being based on the cavity length L,

the specified lower bound having a value of 50 mW for cavity lengths between approximately 1000 um and 1380 um, a value equal to the quantity (1mW)*[(L-1280 µm)/2µm)] for cavity lengths of 1380 µm to 1480 µm, a value equal to the quantity (1mW)*[(L-1260 µm)/2.2µm)] for cavity lengths of 1480 µm to 1700 µm, a value equal to the quantity (2mW)*[(L-1600 µm)/1µm)] for cavity lengths of 1700 µm to 1750 µm, and a

value of (3mW)*[(L-1510 μm)/2μm)] for cavity lengths of 1750 μm to approximately 1770 μm, and

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the specified upper bound having a value equal to the quantity (2mW)*[(L-950 μm)/1μm)] for cavity lengths of approximately 1000 μm to 1050 μm, a value equal to the quantity (2mW)*[(L-750 μm)/3μm)] for cavity lengths of 1050 μm to 1200 μm, a value equal to the quantity (2mW)*[(L-450μm)/5μm)] for cavity lengths of 1200 μm to 1350 μm, a value equal to the quantity (3mW)*[(L-150 μm)/10μm)] for cavity lengths of 1350 μm to 1450 μm, and a value equal to the quantity 390 mW for cavity lengths of 1450 μm to ~~approximately 1770 μm.~~

57. (Once Amended) A method of increasing the photoelectric conversion efficiency of a semiconductor laser, the semiconductor laser including a semiconductor laminated structure having a substrate, a lower cladding layer, an upper cladding layer, an active layer disposed between the lower and upper cladding layers, a first electrode, a second electrode, a front facet to output the laser beam, a back facet, and a cavity length L between the front and back facets, the active layer being configured to generate light such that the apparatus provides optical output power at the front facet in response to a source of electrical power applied to the first and second electrodes, the cavity length L being in the range of approximately 1000 μm to approximately 1800 μm, the semiconductor laser further including a low reflectance coating disposed on the front facet having a reflectivity of less than approximately 4%, and a high reflectance coating disposed on the back facet and having a reflectivity of more than approximately 80%, said method comprising the step of:

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operating the semiconductor laser at an optical output power level P_{OUT} which is less than or equal to a specified upper bound and which is greater than or equal to a specified lower bound, the specified upper and lower bounds being based on the cavity length L,

the specified lower bound having a value of 50 mW for cavity lengths between approximately 1000 um and 1380 um, a value equal to the quantity (1mW)*[(L-1280μm)/2μm)] for cavity lengths of 1380 μm to 1480 μm, a value equal to the quantity (1mW)*[(L-1260 μm)/2.2μm)] for cavity lengths of 1480 μm to 1700 μm, a value equal to the quantity (2mW)*[(L-1600 μm)/1μm)] for cavity lengths of 1700 μm to 1750 μm, and a

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value of (3mW)*[(L-1510 μm)/2μm)] for cavity lengths of 1750 μm to approximately 1770 μm, and

the specified upper bound having a value equal to the quantity (2mW)*[(L-950μm)/1μm)] for cavity lengths of approximately 1000 μm to 1050 μm, a value equal to the quantity (2mW)*[(L-750 μm)/3μm)] for cavity lengths of 1050 μm to 1200 μm, a value equal to the quantity (2mW)*[(L-450 μm)/5μm)] for cavity lengths of 1200 μm to 1350 μm, a value equal to the quantity (3mW)*[(L-150 μm)/10μm)] for cavity lengths of 1350 μm to 1450 μm, and a value equal to the quantity 390 mW for cavity lengths of 1450 μm to approximately 1770 μm.

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65. (Once Amended) A method of forming a semiconductor laser to provide reduced power consumption or increased photoelectric conversion efficiency for a selected output power level P_{OUT} in the range between approximately 50 mW and approximately 400 mW, the semiconductor laser including a semiconductor laminated structure having a substrate, a lower cladding layer, an upper cladding layer, an active layer disposed between the lower and upper cladding layers, a first electrode, a second electrode, a front facet to output the laser beam, a back facet, and a cavity length between the front and back facets, the active layer being configured to generate light such that the apparatus provides optical output power at the front facet in response to a source of electrical power applied to the first and second electrodes, the semiconductor laser further including a low reflectance coating disposed on the front facet having a reflectivity of less than approximately 4%, and a high reflectance coating disposed on the back facet and having a reflectivity of more than approximately 80%, said method comprising:

selecting the cavity length to be within one of four ranges depending upon the value of the selected output power level P_{OUT},

the first range being between approximately 1000 μm and approximately {2μm*(P_{OUT}/1mW) +1280 μm} for values of P_{OUT} between approximately 50 mW and approximately 100 mW,

the second range being between approximately {1μm*(P_{OUT}/2mW)+950μm} and approximately {2.2μm*(P_{OUT}/1mW) +1260 μm} for values of P_{OUT} between approximately 100 mW and approximately 200 mW,

the third range being between approximately $\{3\mu m*(P_{OUT}/2mW)+750\mu m\}$ and approximately $\{1\mu m*(P_{OUT}/2mW)+1600\ \mu m\}$ for values of P_{OUT} between approximately 200 mW and approximately 300 mW, and

A7 cont

the fourth range being between approximately $\{5\mu m*(P_{OUT}/2mW)+450\ \mu m\}$ and approximately 1750 μm for values of P_{OUT} between approximately 300 mW and approximately 360 mW, and

the fifth range being between approximately $\{10\mu m*(P_{OUT}/3mW)+150\ \mu m\}$ and approximately $\{2\mu m*(P_{OUT}/3mW)+1510\ \mu m\}$ for values of P_{OUT} between approximately 360 mW and approximately 390 mW.

Please add new Claims 73 - 80:

73. **(New)** The fabrication method of Claim 39 wherein said step (a) additionally acquires the relationship of the electric drive power as a function of the cavity length;

wherein said step (b) determines values of the cavity length and the impurity carrier concentration from the acquired relationship such that the electric driving power is vicinal to a minimum for the desired optical output power; and

wherein said step (c) forms the semiconductor laser apparatus with values for the cavity length and the impurity carrier concentration that are determined by step (b).

A8

74. **(New)** The method of Claim 31, wherein the active layer is configured to generate light along at least 1000 microns of the length of the cavity.

75. **(New)** The method of Claim 33, wherein the active layer is configured to generate light along at least 1000 microns of the cavity length.

76. **(New)** The method of Claim 39, wherein the active layer is configured to generate light along at least 1000 microns of the length of the cavity.

77. **(New)** The semiconductor laser of Claim 41, wherein the active layer is configured to generate light along at least 1000 microns of the length of the cavity.